

EMOTION – AROUSAL AND CONTROL

MUKUNDAN C. R.

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Message from Editors

We have been committed to make our “*Author Freedom Policy*” better due to response given by our researchers. We have launched “***Gold Open Access System***” before some days, which have gained good feedback by researchers. Now, every title will get its own URL which would be included by Abstract, Keywords, DIP (Digital Identifier Passport) etc. The main benefit of the URL is that, researcher can share and show it in his profile, CV, resume etc.

We shall present nomination of “**Paper of the Year**” award within short time. IJIP plans *Paper of the Year award* every year to inspire its researchers. After nomination, it would be lived at the website. Then it would be opened for voting. It would be voted by IJIP website visitors. That nominee would be awarded who would get majority of votes. In short the point is website visitors make him winner of the award. You can get more information regarding this matter from IJIP official website (www.ijip.in/index.php/award.html)

Year 2016 is the year of new hopes, new tries, and new dreams to be realized into reality. We pray to God fulfill all your wishes and dreams. We thank here all the researchers and friends joined with us.

We experience here feeling of joy while presenting first issue of 2016. We thank you again researchers who have presented their articles in this issue.

Happy New Year...

Dr. Suresh Makvana¹
(Editor in Chief)

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Prof. C.R. Mukundan has been working in the area of Cognitive Neuroscience since 1964 and he set up the first cognitive electrophysiology laboratory at the National Institute of Mental Health & Neuro Sciences, Bangalore, India in 1975. He conducted research in the area with a team of faculty and students from the Departments of Clinical Psychology, Psychiatry, Neurology, Neurophysiology, and Neurosurgery. They worked on EEG with computerized analyses, Evoked, and Event Related Potential paradigms in schizophrenic patients, patients with alcohol dependence and patients with traumatic brain injury, etc. for the next 3 decades. His latest

experimental work was in the area of testing the EEG and ERP activation patterns in remembrance of experiences, and he succeeded in developing a technology, which came to be called Brain Electrical Oscillations Signature (BEOS) profiling. The patented technology has been since used as an aid for forensic investigation. Other than the original normative study, several hundreds of cases have been examined by the test and it has successfully helped the investigators to identify real perpetrators, and the results helped exoneration of innocent individuals. The technology that he started trying out, when he was in NIMHANS, got the software developed by Axxonet Technology Solutions in Bangalore. The technique helps to test different possible formulations and different roles played by the individuals suspected or accused to be involved in an act. The important advantage of the test is that it does not expect any behavioural or oral response from the individuals when they are expected to listen to set of verbal probes during the test. Further, the system presents the probes only if the subject is attentive. The system automatically conducts extensive signal analyses to determine presence of sensory registration, semantic processing, accessing source memory, attentional shift, presence of imageries, and emotional responses using frequency and time domain analyses of EEG after determining their statistical significances.

He has been working on understanding cognitive processing methods. He was one of the first few who reported on the sequential and simultaneous nature of signal inputs into the brain and their differential effects on the development of processing methods in the brain. The neuropsychological tests that he developed in the early 1970s had shown that encoding in both visual and verbal tasks could be impaired in left frontal lesions. Similarly, he had developed tests of working memory and used it as a sensitive test in frontal lobe lesion patients. The Brain Function Therapy system that he developed for computerized cognitive retraining has been since then, extensively used for cognitive training of children with learning disorders, ADHD, and patients with addiction and traumatic brain injury.

He assembled EEG amplifiers for his laboratory in the 1980s, and published the first research papers using computed EEG analysis, EP, and ERP measures from India. His work supported the notion of automatic initiation or neurogenesis of actions, which helped the postulation that action is automatically initiated when emotional arousal reaches a Critical Level of Potentiation. He suggested strict social conditioning as the only neurodevelopmental method and remedy for

training in the control of emotional arousal in individuals, which would beneficially help the society, as individuals would learn to control themselves by blocking asocial behaviour. He has been working on the role of emotion for a decade, though could come out with an explicit theory only now, which is considered an alternative to consciousness.

Since March 2013, he is working at Institute of Behavioural Science, Gujarat Forensic Sciences University, Gandhinagar, Gujarat as the Director and Emeritus Professor. In this short duration he has established state of the art Neurocognitive Electrophysiology Laboratory at IBS. The lab consists of 32, 64 channels EEG and ERP systems, Neurofeedback systems, Polygraph and BEOS systems, and Brain Function Therapy for cognitive retraining programs. He started India's first Neuropsychology and Forensic Psychology postgraduate courses, which are flourishing under his guidance. He has organized various seminars, conferences, and workshops in the area of Neuro and Forensic Psychology at IBS. He is also conducting various training programs for Neuro/Forensic psychologists and police officers across the country at IBS. He has also established the Cognitive Neuroscience Society of India (CNSI) in 2014. He is the first President of the society. He has published several original research papers in peer-reviewed journals. He has written three books in his areas of interest.

Searching for Emotional Arousal

Searching for truth, searching for force beyond the realities known, searching for presence of a superior force, with one's own body and mind, differentiating and identifying the mind and its processing methods have been the goal of human pursuits for centuries. Ancient wisdom took us to the parlors of total devotion and love for a force, which they considered supreme on the one hand, and on the other, they pointed out how ultra paradoxical is the universe in an absolute format. Bertrand Russel said that he searched for rationality in his whole life. He and many more could think of the universe and its components only relatively, as human capabilities cannot take one beyond a relative evaluation, and everything that we know have only relative strength and existence. Many of us are still happy to think of an ultra paradoxical existence of the universe, as a burst of energy. Many believe that energy is present in each of us in the form of consciousness!

The need to examine consciousness from a medical point of view has been compelling, as death is the end of presence of expressions of consciousness. However, consciousness turned out to be essentially the functional property of the sensory-motor systems and how these systems helped in making reality contacts. Even awareness turned out to be essentially the outcome of a verbal monitoring process of own thoughts and speech. We semantically transcode every experience and contact with reality, and thereby develop its verbal awareness. Consciousness as a universal energy has been only another fictional thought. Assumption that it is a form of force behind reality, remaining beyond the reach of human contacts served it as a magic force of human mind, helping in fantasizing its presence.

Knowing about normal emotion has been the least important, as excessive emotional outbursts and absence of emotions always led to pathological dimensions, and human behaviour needed lasting emotional corrections. The need to control emotions was always advised as a great need for success in life. Decisions are to be constantly made devoid of emotional biases. Understanding of emotion has been always from a point of view of receiving and offering pleasure and pain for the self and others. Though we know emotion serves as the fuel of life, and it is driving each living being, we always realized it could take us to success as well as failures, as we could not easily consider emotion as energy beyond the cognitive labels used for identifying their expressions and experiences. Hence keeping emotion under control is a moment

to moment or continuous task for each human being. Excess of emotions and their deviant effects have always caused disturbing to disastrous effects to individuals and human community. Emotion of love has helped to carry out self-sacrifices in some, whereas love for one or an idea has frequently led to hatred and destructive and demolishing behaviour of others. Emotion, which does not lead to self-gains, is seldom given importance in life. To be emotional is often treated as a personal weakness rather than strength. Most people consider only selected emotional experiences and expressions as desirable. Even those strong emotions are often considered to bring out weakness and undesirable expressions and induce aggressive or damaging responses in many individuals. Emotion is considered useful only when one can gain from its expressions.

Emotional arousal serving as a drive is essentially a scientific notion. People in general consider drive as a motivating force, as the personal requirement for carrying out actions for achieving goals. Emotion is often equated to its aggressive and abnormal expressions and experiences, which in excess interferes with actions and achievements, or needed for intimate personal relationship across individuals. Emotional experiences associated with subtle emotional states produced while listening to music and in meditation, etc. is still vague and unclear. Though the words emotional arousal and drive are used synonymously, semantically the former is used to emphasize or focus on being excited while the word drive is used to imply a force of propulsion. Can we in reality differentiate between the two in actual use? The differences across individuals, if present, may only be in the physiological and psychological effects, in the cognitive appraisal of the object-mind-body conditions of a person in different pursuits or travel in different paths. The cognitive differences detected in different emotional states reflect or indicate the nature of expectations, personal gains, and sensory-motor contacts made with reality. The cognitive appraisals take us only to their personal gains and effects, and we fail to observe and treat it as a force without which the individual cannot live.

“I know I need the drive for getting up after a sleep, move around the house, sit and read, learn, eat breakfast, get ready and go to school, office or to other places. I need the same force for going to market, visit friend’s home, to be with a friend, have fun with the friend. I need it every day for multiple needs, including visiting other parts of the country, attending meetings, and for engaging in all those creative pursuits, provided one has such endeavors. Of course, I label each

act differently, and the interest that I have in each of these activities differs, as my personal gains are different. I fail to accomplish to carry out an act, when I am not aroused or have enough drive, or fail to be aroused. I miss the act then and do not play my role. I can do nothing, if I miss it, as I know I do not have interest in it, and have no drive for doing it.”

We need to rediscover emotion and what it does to a living being, beyond its biological and cognitive effects, if any such possibility is possible.

EMOTION – AROUSAL AND CONTROL

Emotion is the most subtle as well as complex psychological experience and expression, seen in living beings. Emotion serves the survival needs of living beings and it may be considered the force of life, without which the living being cannot have responses and actions. Emotion is acquired as an experience and one learns to not only experience by but also become aware of it, and semantically express it through personal cognitive appraisals. Such cognitive appraisals render emotions as facilitating or debilitating experiences, creating positive and negative effects on experience and the expression of emotions. Cognitive appraisals help provide multiples of labels for the emotional experiences and their expressions, depending on the specific contexts, and their effects on the self and others. Happiness within certain range is found to be the only emotion, which may not be associated with any personal gain, when the subjective feeling may be mixed with tears, but without grief. The most important role of emotion is that it serves as the drive for living, acting, and achieving goals in life. Flight and fight responses may be triggered without perception and awareness of an emotion provoking stimulus, when emotional responses may be triggered from memory of experiences. All other responses and actions require emotional arousal. The efficiency of a specific performance is function of the complexity of the task and the drive employed. Neurogenesis of actions takes place when emotional arousal reaches certain critical level of potentiation (CLP), even though awareness of initiation of action may not be present. Learning to control and adjust emotional arousal is therefore, the most important need for gaining self-controls for responding to situations in the most appropriate manner and working for achieving goals. Learning self-control of emotional arousal is an important aspect of social conditioning, which helps them to perform and behave in socially accepted manner, safeguarding, and preserving the social values of the society. Large areas of the frontal cortex are engaged in the inhibitory control of emotional responses and performance of the sensory-motor systems of the brain. Response inhibition ability is a critically important aspect of socialization process, which each growing infant needs to acquire during the neurodevelopmental stages. Acquisition of such controls on the deployment of emotional arousal facilitates each person learn to use emotional arousal intelligently and in socially approved manner for expressing and achieving the best performance.

Key Words: *Emotional arousal, drive, cognitive appraisals, experiential state, Critical Level of Potentiation, responses and actions.*

Emotional Experience

Historically, emotion has been a difficult topic for scientific understanding, though every human being experienced and expressed emotion. Emotional expressions have been noticed in animals too. All literature available on human behavior is about experiencing emotions, its acquisition, and expressions in speech and behavior. Emotion has been traditionally defined as energy needed for movements and actions. Emotion has been always considered a personal experience and presence of emotions associated with an experience always facilitated its remembrance. Highly varying emotional experiences and their equally highly varying behavioral effects contribute to the consideration that emotions take the system beyond physical realities. The experienced emotion is also described as the subjective feelings of the person. Emotional experiences and expressions are twofold; we have called them positive and negative emotions. When Negative emotions are negative, a person experience apathy, grief, fear, hatred, shame, blame, regret, resentment, anger, hostility, whereas positive emotions contribute to the experiences of being interested, enthusiastic, happy, empathetic, and curious. Concepts of arousal and drive, and the brain mechanisms (cortical – limbic and autonomic) and neurotransmitters associated with arousal, wakefulness, and performance have been explained in several original pieces of work (Yerkes, Dodson 1908; Morruzi, Magoun 1949; Hebb 1949; Sherin et al. 1996; Dringenberg 1998; Sarter, Bruno, 1998; Gallopin et al. 2000, Lu et al. 2000, McGinty, Szymusiak 2000; Saper et al. 2001; Jones 2003; Saper et al. 2005a, Saper et al. 2005b, Jonathan, Schwartz 2008). Emotion is always considered a core function of the limbic system accompanied by heightened physiological arousal. The word emotion refers primarily to the subjective or experiential state of being aroused. It is indeed the outcome of activation at neurobiological levels. The neurobiological activation may vary from basic functional levels to heightened levels, which may be optimal or interfering and damaging the performance and behavior. The changes in these effects are experienced, and each individual learns to know and use this state as the subjective reference base of emotional arousal. The emotion experienced need not always be intense and debilitating, it can be mild to intense and facilitating. The facilitating or debilitating effects is the outcome of cognitive judgment accomplished by each. What is important is the fact emotional arousal is a prerequisite for all types of performances and behavior. It is the personal emotional satisfaction or wish not to cause displeasure to others that each person strives to achieve in many actions carried out in life. The cognitive and sensory-motor accompaniments, which create each

of these experiences, differ across individuals, and the differences may reach near infinite levels. Emotion is primarily an experiential state, accompanied by physiological changes, and their proprioceptive and performance-behavioral effects. Emotion is experienced as a force within, propelling the self to move, respond, and act. These bodily effects and their external outcome are cognitively appraised by the experiencing person and it helps give highly specific self-descriptive accounts of the emotional state and effects. The effects of emotion are seen as positive or negative in an individual, as it can drive a person in opposite directions. As a drive, it serves as the motivating factor. These effects are seen in the behavior and actions of each individual. One has to learn to manage not only own emotions, but also emotional expressions of others whom he lives and work with. This is possible only if one learns to empathize with others. Emotion manifests or expresses itself with positive or negative effects based on the cognitive appraisals used. Emotional arousal results in the physiological activation of the body for responding and carrying out actions. Emotion, in this sense may be considered the same or equivalent to consciousness, which is hypothesized as a marker and force of life. Verbal awareness of emotions and its components occur when the changes or experiences are semantically transcoded by one. Verbal awareness occurs when the listening brain monitors the processing in the talking brain (Mukundan 1998, 1999a, 1999b, 2007, 2015). Emotion serves as the driving force of all actions. Absence of emotion results in different type of effects, which may cause debilitating effects, poor performance, and achievements in life. Several of these cognitive controlling mechanisms shape the experience and expressions of emotion and its effects in the life of an individual. It is already established that emotion can be triggered and associated responses may be elicited by a stimulus, even without its perception and awareness (Ledoux, 1996, 1998, 2003; Morris et al. 1998; Whalen et al. 1998, 2004; Windmann, Kruger 1998). This is considered important for the survival needs in animals. Human beings also may infrequently show such polyvagal behavior (Porges 2001, 1998), though they are no more socially in such threatening needs. Emotional arousal is indeed considered different from the state of life produced by respiratory intake of oxygen and supply of blood and other neurochemical substances throughout the body.

Emotional Arousal

Ability to use emotional arousal for triggering responses and actions in a controlled and beneficial manner has been labelled emotional intelligence (Goleman 1995, Salovey, Mayer 1990). Emotional experiences and emotional arousal are still not well-understood properties of living beings. Control of emotion is of paramount importance to human beings, as emotional arousal is required for peaceful, productive, and socially accepted and creative behavioral responses in each individual. Emotion serves as the fuel of life, and there cannot be any response or action without being propelled by emotion. On the other hand, emotional responses may become destructive with self-damaging effects, when emotional arousal is employed by individuals to work towards destruction of others. One may easily find justification for all these destructive actions and many individuals often form thoughts and belief systems, which sponsor such hateful and destructive actions. Using physical force against physical force may be natural phenomenon, but human beings can grow to respond differently from normal patterns of such responses of nature. Jesus Christ may have been the first known human being, whom we identify as a spiritual leader, who could show and teach that love can be used in return to hatred. We argue, as diseases are to be eliminated, diseased minds need elimination. Therefore, control of emotions is the basic requirement for controlling and regulating all forms of behavior. Self-evaluation of experience of emotion constitutes another important dimension, as need for controls are adjudged from such evaluation. Evaluation may consist of labelling the emotional state based on a need state, and the consequent effects. Such cognitive appraisal of emotion is yet another skill, which one has to learn and use for controlling emotional arousal strategically, so that emotion is allowed to release responses in a controlled and beneficial manner.

Emotion has been identified as positive or negative, depending on its expressive effects or absence on the person and others. Emotion is required as the driving force for initiating and maintaining actions and responses. Emotion is considered essentially an experiential state, when the individual is conscious and alert. However, emotions are present in dreams also. Emotion is experienced as a positive drive by the individual, propelling actions and responses from them. When the emotional arousal is high and one is propelled to make set of actions for achieving a certain goal, it may affect routine life, eating and sleeping habits, as one may become inspired to work all the time. If the goal sought is socially acceptable, such work habits may be appreciated.

If it is not a socially acceptable and approved behavior, which one has carried out, because of intense emotional needs or compulsions, as one could not control the emotional drive it may be considered a criminal and offensive behavior. One may be able to experience the presence of the drive, and may be able to make out when it is significantly reduced and not adequate enough for carrying out even simple movements and actions. When emotional arousal is totally and continuously absent, the individual is in a vegetative state, even though the person may remain conscious with intact and functional sensory-motor contacts with reality. The deficits depend on the area of the frontal-sub cortical areas of the brain and the circuits involved in emotional regulations that are removed in most of the psychosurgical interventions. Some of these structures are amygdala, hippocampus, parts of the thalamic and hypothalamic nuclei, cingulate gyrus, and prefrontal and orbit frontal cortex (Price et al. 2001; Mathews, Eljamel 2003; Heller et al. 2006). Some of the normal emotional states cherished by individuals are those related to experiencing motivation, pleasure, and excitement. The frequent or continuous presence or reduced presence of emotion is considered to determine the temperament of an individual. Absence of positive emotions or presence of negative emotional valance are disturbing and debilitating to the individual, and they adversely affect interpersonal relationships and the life style of an individual. The cognitive labelling and estimations that result in the development of emotional states with positive and negative valances, direct physiological effects and the responses fueled by emotions in those directions. Being conscious and in contact with reality, are hardly enough to become more than robot. Essence of being a human being may be seen only when one creates ideas and meanings, and when one navigates and acts for creation and achievement of those goals in life. These will never happen without emotional arousal.

Initiation of Action

It is well established that emotional arousal or drive develops well before an action is initiated (Libet 1985, 1999; Matsushashi, Hallett 2008; Soon et al. 2008; Mukundan et al. 2014, 1986) and the individual becomes aware of the action initiated. Action is automatically initiated when the emotional arousal or drive reaches a Critical Level of Potentiation (Mukundan et al. 2014). One has the choice and freedom to learn to control emotional arousal well before it reaches the critical level, and thereby control the actions. If such self-control on emotional arousal is absent, actions and responses are initiated without knowledge, and one may become aware of the

undesirability and unacceptability of the action, only after its initiation and execution. The emotional arousal or drive required for all acceptable, and no acceptable and violent actions, are the same. What are not acceptable may be only the actions and responses. Absence of control on emotional drive may precipitate all actions. As emotional drive, we experience it as a life force and its origin and manifestations as emotional experiences and expressions in the limbic system of the brain have been understood. It is my proposition that it is the same drive, which has been identified and labelled as consciousness by spiritualists. Within neuroscience, consciousness means the state of being able to carry out sensory processing, recognizing - knowing, being able to think or speak, and become aware of the thoughts and know or monitor the sensory-motor processes taking place. Philosophically it is described by many as the force of life, and it has become a focus of thinking from a Quantum theory point of view, as the universal force of life, beyond matter and science. The ancient semantic reference to an ultra paradoxical state of existence of the universe is indeed immensely rich, as it indicated a state in which all opposite qualities merge into one and hence they become an impossible state of reality, though its existence as an entity was not questioned. On the other hand, reality can be known or measured only relatively. It is the unreality associated with absoluteness, which could have given rise to the semantic reference of Parabrahma. This helped to accept Parabrahma as a culmination of all conflicting and opposing universal qualities, designed for referring (?) to an impossibility of absolute reality. Within neuroscience, being conscious is not enough for responding and acting. One could be conscious and still unable to move or act. Action or response needs drive or arousal and it is this drive that has been equated to emotional arousal. However, this drive is essentially an experiential state, though physiological and brain responses accompany it. The arousal state is colored with various cognitive appraisals made on the demands of the state, when we label the states as joy, pleasure, aggression, anxiety, pain and pleasure, etc. Emotional arousal gets thereby cognitively labelled, which become part of semantic and other self-examinations. Emotional drive is a basic requirement for all performances. One needs drive to move voluntarily even the little finger. Quality of performance and achievements are a direct functional outcome of basic emotional arousal. Emotions may trigger both desirable and undesirable actions and effects. When emotions trigger desirable and socially approved actions, and when one has control on emotional arousal to help avoid undesirable actions, it is considered emotional intelligence. The presence of controls one

acquires on emotional arousal, which facilitates positive performance and block negative performance contribute to emotional intelligence. Performance is indeed cognitively controlled and creative performance and achievements are controlled by both sequential and parallel information processing within the brain. Emotions without socially approved rational thinking, judgment, and controls may facilitate as well as trigger detrimental and damaging behavior. Expression of emotional effects in behavior, while interacting with other people, is also important indicator of affection, love, care, hatred, and dislike, etc. Emotional intelligence reflects the skill and capability one acquires in the control of release of emotional arousal to initiate actions, hoping for achievement, differentially loading behavior and speech with emotional effects in dealing with members in the family, work place and in the society. It incorporates the ability to understand and recognize the emotional expressions in the behavior and performance of others, and ability to monitor own emotions experienced and expressed. There is intense experiential component in emotional arousal, and what we call scientific studies of emotions are mainly on the effects of emotional arousal on the physiology of the body. Physiological consequences are accompaniments of emotional states, especially when there is beyond normal states of emotional arousal and responses in an individual. They may be expressions of the dislikes and hostility one may entertain to others, or loss of precious relationships and feelings, and consequent sadness. Such emotional effects indeed have their own origin, seen in the psychophysiological responses of the system, along with consequent mental responses and effects.

Learning Emotional Controls

Emotional arousal and its controls need to be cultivated during the developmental stages, so that the grown up has adequate drive to work hard and achieve goals in life. Emotional arousal is a state of experiencing a need to act, achieve, possess, respond, or attain a state, and the need works as a force propelling the individual to get into movements or action for achieving the goal. Emotional arousal has such intricate and overwhelming effects as it initiates and maintains behavioral responses of an individual. Emotion indeed is the driving force of life, without which the living being – man cannot accomplish anything. Efficiency of performance has been found to be a function of the complexity of a task engaged in and the degree of arousal with simple tasks requiring higher levels of emotional arousal, and complex tasks requiring lower levels of arousal.

The level of emotional arousal has been found linked to the cognitive appraisal of the need states one creates, which grows beyond the regular survival needs of the living system. Man thinks, creates new ideas and new realities, all of which become the needs of the individual. Emotion at the original level of occurrence must be understood without the cognitive labels of the needs that we use in describing different emotional effects. Emotion has been always experienced and described as the drive or driving force within the individual. The non-materialistic component experienced in emotion could only be semantically described, and has been classified as a psychological component. This is partly like the description of consciousness from a spiritual point of view, which is projected as an independent and universal force existing beyond the material world. Consciousness is described as a spiritual component serving as the force of life and existing beyond matter and science. However, emotion is to be cultivated in each individual from the time of birth and is experientially present within the system. Emotion is required as the fuel for driving the system physiologically, and needed for all responses and actions, in which there is extensive body participation as in movements and needed even for semantic processing. Objective observations have always been through the changes in the neurobiological states and through proprioceptive and exterior movements. However, what serves as the drive is only experienced by the individual and actions are an expression of the effects of the drive on the system. The shades, variety and the complexity of emotions experienced and expressed are known to be influenced or determined by the cultural - life patterns of the group or society, wherein the individual has grown up. Presence of emotional expressions related to survival needs, without perception of a threat clearly supports its precognitive origin and presence in the body. The complexity, decisions, and continuance of movements, which contribute to actions, can be considered indicative of the strength and presence of the driving force i.e. the emotion. The neuroanatomical representations of the emotion sub serving areas in the brain i.e. limbic system and their controlling/associated centers in the brain contributing to emotion and emotional controls have been under investigation for several decades. What we have not understood is the specific nature, if any present, of the neural activation sub serving what we experience as emotion. We have not measured emotion per se, as a particular physical force, though we know the sources representing its neurophysiological origin, and varied neurophysiological and psychological effects. We know that emotion as a driving force – needs to be cultivated in the system, and we can consider it equivalent to a

physical force or fuel in a system, as it energizes the body-mind to work. Its presence and effects experienced by one are cognitively assessed and described. Sociocultural variations produce equivalent variations in the experiences and expressions of emotions. However, we cannot say that emotion is different as a drive in individuals. We cannot say that, as a force, it is either different in men and animals. Emotion is a highly suggestable experience, and a state, which can easily be self-induced or induced by others. The fact that human beings use a highly developed semantic and cognitive processing system makes their emotional experiences and expressions highly more complex, explicable, consequential, and sublime.

However, emotional arousal is a general state, its occurrence with specific stimulating conditions and needs bring about urge for initiation and continuation of the specific actions until results are achieved. It makes one to work hard, compete with others, and brings out the best of talents in performance. There is also need for one to release the drive and direct it in the right path, so that actions are directed to relevant goals and they do not hurt others or interfere with the legitimate rights of others. This means that emotion must be released in a controlled and intelligent manner so that the social system, which supports and protects the individual, remains preserved. The arousal itself may not have any strong positive or negative valence effects, until the individual recognizes its various effects. Emotional expressions may result in aggressive outbursts, when survival is threatened or the person is conditioned to such responding patterns. Social conditioning practiced as a general principle in a society or within the life circle of a person would play important role in conditioning one to presence of emotional controls. However, absence of such social conditioning during the developmental stages leaves a child without emotional controls, which may precipitate interfering, and destructive effects or behavior. Social conditioning modulates the responses and actions so that the social norms of behavioral expressions are maintained in the society. Response inhibition may start as a forced practice for cultivation of the ability, which gradually enables the growing child and adult to hold back emotional arousal so that related responses and actions are not automatically initiated. Self-induction of training on emotional arousal also helps cultivate immense controls on emotional arousal and related expressions. Meditative practices may be the best way to cultivate such self-controls, so that one can use emotional arousal for self-development to enable navigation and achievement of mighty goals in life.

Unbranded Emotional Arousal

Emotional arousal in its unbranded form may induce intense alertness and urge to access the capabilities of the system - brain and body for scrutinizing and solving problems. Happiness is the most basic and primary emotional state that may occur in such unbranded levels, even when one has no personal cognitive demands. Happiness may occur in life, with a vision of a natural scenario like rising sun, greenery, flower, and with the sights and thoughts of several dear persons and possessions. Happiness is attained listening to music and ideas, and thoughts of belongingness. Happiness may also be achieved through body movements, like in dance, listening to music, and singing and other creative efforts involved in thinking, problem solving, and designing and creating new devices and products. It may be the natural outcome of all achievements in life, though what one considers achievement need not be material possessions. Happiness is experienced without any material gain to the individual. Happiness may also be accompanied by tears, subtle behavioral outbursts in a person, and it may allow one to sacrifice own life for the happiness of others. On the other hand, sadness and depression occurs only with losses of loved, loss of material possessions, and being unable to set and achieve goals. The only traditional equivalent of happiness, to me, appears to be the concept of “bhakti,” which is an experiential combination of love, blissfulness or devotion, and faith. This indeed needs lot more critical exploration. Happiness cannot therefore be considered opposite of sadness or vice versa. Cognitive appraisals of the gains and losses help labelling emotional arousal accordingly and one starts identifying own emotions with those labels. Attaining that mental state of achieving and maintaining happiness or a state of primary emotional arousal without any labels may be the target of several spiritual pursuits and meditative efforts. One has to learn skillfully the art of cognitive labelling so that emotional drive can be used as steady fuel for living a creative life, meaningfully navigating for achieving goals in life. A growing infant learns to be happy with explorations, movements, activities, and belongingness. They get easily used to becoming happy, and the need to become happy drives each child into adventures and excitement, which becomes a personal need, as one grows up. However, absence of opportunities to become happy may deprive the child of the opportunity for cultivation of this drive. Happiness may occur both by real sensory-motor contacts, as well as through imagination of what one wishes to attain. Happiness is indeed an experiential state, as another person cannot share the same happiness or it cannot be induced by altering the physiological activation patterns. Moments of happiness may

become nil or rare in life as one grows and is wrapped up in the complex and challenging experiences of life. One can become happy seeing and knowing another is happy. Singing and listening to music are known to induce happiness, though the happiness and emotional arousal created by certain types of music may be more intense and lasting. Happiness may produce a physiological state, but one may experience happiness even when suffering from pain and discomfort. Happiness may not be associated with increased physical energy, though it does influence the physiological state. It may indeed have a physiological base as controlled intake of external substances like certain drugs and alcohol, etc. can induce states close to happiness. The same may become disastrous and self-damaging, when one becomes excessively dependent on the same substance. Feeling of wellbeing may be achieved even by a person awaiting death. One can attain happiness even while suffering from various physical inadequacies, diseases, and inequalities. Thus, poverty does not take away happiness and possession of immense wealth need not contribute to happiness. However, one needs to learn to be happy during the developmental stages, which occurs as a normal phenomenon unless feeling happy is blocked by others in the family of a growing child. All those adventures the child learns to carry out, in turn, brings further joy, satisfaction, and sense of achievement, help cultivate emotional arousal. The need to feel happy may therefore be considered the most significant driving force in human life. One may go through intense personal suffering hoping to achieve a goal that may bring happiness in life. However, there is nothing to make us consider that emotional arousal or happiness may be beyond matter and above scientific inquiries.

The driving capability may be considered the basic functional role of emotion. Emotion comes to exist as a force driving individuals to move and act, and transforms itself into a complex force, propelling positive and negative behavior and their related experiences. We can learn to control our movements and behavior by learning control of the emotional drive. Learning to maintain emotion in its original state as a drive inducing happiness, and it may be considered the aim of religious or spiritual ways of life. The drive is experienced by one as an urge (Libet 1985) to act. The urge is experienced as a state of alertness and wanting to attend and act. The urge to act is present in all actions, whether they are positive and helping, or negative and causing pain and destruction to others. Alertness helps one to monitor the changes that occur externally and within the body. Alertness also helps to monitor what one listens to and read, which enhances the ability to monitor even minor effects or meanings present in the signals and words received from

outside as well as the ideas and meanings created within, and proprioceptive signals. What we primarily experience in such states of emotional arousal is this alertness, and accompanying sublime feelings. Several living practices engaged by people for thousands of years help work on emotional arousal as well as happiness. Hence, we have always encouraged practices of these, like meditation, and spiritual attachments, which has been called “Bhakti,” and prayers for attaining happiness, as well as drive for living a positive life. If we further work on this state, it may unfold differently, helping further its semantic interpretations. Intense emotional responses accompanying components of aggressions, hostility, rejection, and sadness are the results of abnormal deviations of emotional arousal from subtle levels, which may also have abnormal biological correlates. These states disrupt the normal driving force and may produce destructive effects on the self and others. They are indeed different from the primary normal emotional arousal, which serves as the drive for life.

Emotion is present in all living beings. The manifestations and behavioral effects of this experiential state can indeed be detected and measured. In its most elementary and subtle levels, it may manifest as happiness. It manifests in positive and negative forms at higher intensity levels, depending on the cognitive appraisal of the need state of the living being. Need to explore and excel in work, discover and invent, and to accept challenges are the essential states, which make life adventurous and successful, and needed to obtain continuity of existence for the human race. Emotional expressions have often been intense and self-destructive, supported by belief systems and logics of continuation of existence of humankind. Opportunity and efforts for finding moments of primary happiness may indeed become rare. It may require intense and complex self-adjustments and rehearsals for creating those moments of experience of such states of happiness, until one may learn to create easily a mental state supporting its need and continuous experience. On the other hand, more intense positive and negative emotional experiences with behavioral expressions have become common accompaniments of life. Emotion serves as the prime force of life, serving as the drive for living, and finding expression in subtle to complex behavior and contributing to feelings and expressions according to their cognitive appraisals by the individual.

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Prof. C.R. Mukundan has been working in the area of Cognitive Neuroscience since 1964 and he set up the first cognitive electrophysiology laboratory at the National Institute of Mental Health & Neuro Sciences, Bangalore, India in 1975. He conducted research in the area with a team of faculty and students from the Departments of Clinical Psychology, Psychiatry, Neurology, Neurophysiology, and Neurosurgery. They worked on EEG with computerized analyses, Evoked, and Event Related Potential paradigms in schizophrenic patients, patients with alcohol dependence and patients with traumatic brain injury, etc. for the next 3 decades. His latest experimental work was in the area of testing the EEG and ERP activation patterns in remembrance of experiences, and he succeeded in developing a technology, which came to be called Brain Electrical Oscillations Signature (BEOS) profiling. The patented technology has been since used as an aid for forensic investigation. Other than the original normative study, several hundreds of cases have been examined by the test and it has successfully helped the investigators to identify real perpetrators, and the results helped exoneration of innocent individuals. The technology that he started trying out, when he was in NIMHANS, got the software developed by Axxonet Technology Solutions in Bangalore. The technique helps to test different possible formulations and different roles played by the individuals suspected or accused to be involved in an act. The important advantage of the test is that it does not expect any behavioural or oral response from the individuals when they are expected to listen to set of verbal probes during the test. Further, the system presents the probes only if the subject is attentive. The system automatically conducts extensive signal analyses to determine presence of sensory registration, semantic processing, accessing source memory, attentional shift, presence of imageries, and emotional responses using frequency and time domain analyses of EEG after determining their statistical significances.

